

REMARKS

Entry of the foregoing and reexamination and reconsideration of the subject application, as amended, pursuant to and consistent with 37 C.F.R. § 112, are respectfully requested in light of the following remarks.

Claims 20-39 are pending in this application.

Claims 1-19 were previously cancelled in a preliminary amendment. Claim 39 has been added

Claim 20 has been amended clarify the claim language. Claim 21 and 23-38 have been amended to recite proper claim language by reciting "The process" instead of "A process". Claim 22 has been amended place claim 22 in independent form by incorporating the elements of claim 20, from which claim 22 previously depended, into the claim. Claim 35 has been amended to recite proper claim language in reciting the Markush group. Claim 37 has been amended to recite proper claim language.

Claim 39 has been added. Claim 39 depends from claim 28 and recites the second extraction solvent is fed into the countercurrent extraction column in a direction countercurrent to the first extraction solvent. Support for this amendment is found in the specification at least on page 4, lines 15-18.

No new matter has been added in making these amendments.

35 U.S.C. §103(a) Obviousness Rejections

1. Claims 20, 21, 25-27, 29, 30 and 32-39 have been rejected under 35 U.S.C. §103(a) as unpatentable over Richardson et al. (U.S. Patent 6,307,100) in view of Pesa et al. (U.S. Patent 4,536,597) and further in view of Wu (U.S. Patent 4,120,902).

Applicants respectfully submit that Claims 20, 21, 25-27, 29, 30 and 32-39 are not obvious over Richardson et al. in view of Pesa et al. and further in view of Wu.

To establish a *prima facie* case of obviousness, three basic criteria must be met. (MPEP 2143) First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Richardson teaches a process for the oxidation of cyclohexane to solid adipic acid using air. (col. 1, lines 62-64) Richardson teaches the process yields solid adipic acid where the purity of the solid adipic acid, without recrystallization, can be greater than 95%. (col. 2, lines 11-13) Richardson also teaches that the solid adipic acid can be filtered off, leaving a filtrate that can be recycled. (col. 2, lines 13-22)

Richardson further teaches:

The invention also offers a marked improvement over conventional one step processes in that fewer or simpler purification/recycling steps are required to produce highly pure adipic acid in a cost efficient manner. (col. 2, lines 42-45).

The Office Action indicates that Richardson does not teach using an oxidation solvent that is lipophilic in nature. (page 2).

Pesa et al. teach a method of preparing butyric acid, a monocarboxylic acid, from the reaction of propylene, carbon monoxide and water (col. 2, lines 53-62) and requires a palladium catalyst with a hydrogen halide which is capable of being coordinated with the palladium. (col. 4, lines 25-27) The synthetic process in Pesa is distinct from the process of the Applicant's invention. Both the reactants and products in Pesa are distinct from the reactants and products in the Applicant's invention, as shown below:

| <u>Applicant's Invention</u> | <u>Pesa</u> |
|------------------------------|--------------------------------|
| <u>Starting Material</u> | |
| Cycloaliphatic hydrocarbon | Propylene |
| Oxygen | Carbon monoxide |
| | Water |
| <u>Required Catalyst</u> | |
| Oxidation catalyst | Palladium with hydrogen halide |
| <u>Products</u> | |
| Dicarboxylic acid | Monocarboxylic acid |
| <u>Reaction Type</u> | |
| Oxidation | Hydrocarboxylation |

Pesa teaches using a carboxylic acid having from about 4 to about 9 carbon atom as, or in the solvent, because:

These solvents unexpectedly increase the stability of the catalyst system, the activity of the catalyst with respect to the conversion and also the selectivity of the catalyst to isobutyric acid. (col. 4, lines 49-55)

The Office Action indicates that it would have been obvious to use the octanoic acid taught by Pesa as a solvent in the Richardson reaction for these reasons. Applicants respectfully submit that it would not have been obvious to one of ordinary skill in the art to use octanoic acid in the reaction of Richardson because of the teachings in Pesa for several reasons. First, the catalyst system in Pesa requires palladium with a hydrogen halide which is capable of being coordinated with the palladium. The teaching of increased stability of the palladium/hydrogen halide catalyst in a hydrocarboxylation reaction in Pesa is unrelated to the stability of the catalyst in the Richardson reaction, as these are different, unrelated reactions. One of ordinary skill in the art would understand that information on catalysts behavior is not transferable across catalysts used in fundamentally different reactions. Second, teachings regarding the activity of the catalyst with respect to the conversion of propylene, carbon monoxide and water to butyric acid are totally unrelated to the process of Richardson for the same reasons outlines above for the stability of the catalyst. Finally, teachings of the selectivity of the catalyst to the formation of isobutyric acid are also unrelated to the process of Richardson for the same reasons. Therefore one of ordinary skill in the art would not have combined the teachings of Pesa with those of Richardson because the subject matter of these two references are unrelated and Pesa is nonanalogous art relative to Richardson.

Wu teaches the separation and purification hydrocarbyl aromatic hydroperoxides formed from the oxidation of hydrocarbyl aromatic compounds. (Abstract and col. 1, lines 47-50) Wu teaches extracting the reaction product with aqueous alcoholic base to remove the hydrocarbyl aromatic hydroperoxides and

leave the unreacted hydrocarbyl aromatic compounds which can be recycled back into the oxidation process. (col. 3, lines 31-40)

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. There is no suggestion or motivation in the cited prior art to modify Richardson to obtain the method of the Applicant's invention. The Office Action has not cited a specific motivation to combine the cited references. Applicants believe that Richardson provides motivation not to combine the cited references for at least two reasons. One of ordinary skill in the art would not be motivated to combine the reaction of Richardson with Pesa because of the fundamental differences between the nature of the chemical reactions in the two references, as described above. Such a person would also not be motivated to use a reference on the separation and purification hydrocarbyl aromatic hydroperoxides formed from the oxidation of hydrocarbyl aromatic compounds (Wu), which is also a fundamentally distinct from the reaction of Richardson for similar reasons. Therefore there is no motivation or suggestion in the cited prior art to modify the invention of Richardson with the cited prior art to obtain Applicant's invention.

To establish a *prima facie* case of obviousness, there must be a reasonable expectation of success. There is no reasonable expectation of success in obtaining the method of the Applicant's invention by making changes to the process of Richardson based on the teachings in the cited prior art. As shown above, both of the prior art references are related to different types of reactions than that of Richardson. One of ordinary skill in the art, upon realizing that Pesa and Wu provide

teachings related to reactions that are fundamentally different than the reaction in Richardson, would realize that the teachings cited for these references in the Office Action would not have a reasonable expectation of success in being used in Richardson because of the differences in the reactions, especially concerning the alleged combination as cited in the Office Action, which has been evaluated above. Absent teachings from prior art concerning the same type of reaction as taught in Richardson, there could not have been a reasonable expectation of success in obtaining the Applicant's invention from the cited prior art. Therefore, there was no reasonable expectation of success at the time of the invention that the claimed method could be obtained by modifying Richardson.

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. As admitted in the Office Action (page 2), Richardson does not teach using an oxidation solvent that is lipophilic. The Office Action cites Pesa, which as shown above is non-analogous art to provide a reference to obtain this limitation. The Office Action further admits (page 3) that neither Richardson nor Pesa teach an extraction method of the final product. The Office Action cites Wu, which as shown above is non-analogous art to provide a reference to obtain this limitation. Therefore the cited prior art does not teach or suggest all of the limitations of the instant claims.

Therefore, in consideration of the foregoing, Applicants respectfully submit that Claims 20, 21, 25-27, 29, 30 and 32-39 are not obvious over Richardson et al. in view of Pesa et al. and further in view of Wu.

2. Claims 22-24, 28 and 31 have been rejected under 35 U.S.C. §103(a) as unpatentable over Richardson et al. (U.S. Patent 6,307,100) in view of Pesa et al. (U.S. Patent 4,536,597) in view of Wu (U.S. Patent 4,120,902) and further in view of Boogers et al. (U.S. Patent 6,231,821).

Applicants respectfully submit that Claims 22-24, 28 and 31 are not obvious over Richardson et al. in view of Pesa et al. in view of Wu and further in view of Booger.

The teachings of Richardson, Pesa and Wu have been described above.

Boogers teaches the separation of rhodium from a mixture comprising and organic solvent, C₆-dicarboxylic acids and iodine compounds. (col. 1, lines 8-10) Boogers teaches the use of this process in recovering rhodium from carbonylation reactions. (col. 1, lines 11-17, and 38-41) Boogers teaches the dicarboxylic acids are added to the waste stream. (col. 2, lines 34-37) Boogers teaches that the dicarboxylic acids will partition between the aqueous and organic phases and that the ratio of the concentration of the dicarboxylic acids in the aqueous phase to the organic phase is between 1:1 and 5:1. (col. 1, lines 63-66) Boogers teaches first removing the desired products of the reaction (step (a)), returning the catalyst into the reaction (step (b)) and purging part of the catalyst and removing the rhodium from the purge stream (step (c)). (col. 4, lines 7-18) One of ordinary skill in the art would recognized that the extraction taught by Boogers, if incorporated into an oxidation reaction for producing dicarboxylic acids, would result in the formation of two separation phases (aqueous and organic), each of which comprise significant amounts of the carboxylic acids. which are the desired products in the oxidation reaction. Such a step would add significant complexity to a purification process, as

two separate streams, each containing the desired dicarboxylic acids would need to be further processed to obtain the desired dicarboxylic acids.

Claims 23 and 24 depend from claim 20. The Office Action has not cited Boogers as providing the elements required to overcome the deficiencies of Richardson, Pesa and Wu with regard to obviousness of claim 20. Therefore claims 23 and 24 are not obvious over the combination of Richardson, Pesa, Wu and Boogers as Boogers does not overcome the deficiencies in the rejection of claim 20, from which claims 23 and 24 depend.

Claim 22 has been amended to be in independent form. The elements of claim 20, from which claim 22 previously depended, have been incorporated into claim 22. Applicants note that, as shown above, independent Claim 20 is not obvious over Richardson, Pesa and Wu. The Office Action has combined these three references with Boogers in rejecting Claims 22, 28 and 31, where claims 28 and 31 depend from claim 22. Because claim 22 has been amended to incorporate the elements of claim 20, the combination of Boogers with Richardson, Pesa and Wu does not overcome the deficiencies of Richardson, Pesa and Wu with regard to obviousness of claim 22. Therefore, claims 22, 28 and 31 are also not obvious over Richardson in view of Pesa, Wu and Boogers.

In addition, Claims 22-24, 28 and 31 are also not obvious over Richardson, Pesa, Wu and Boogers for the following reasons.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. There is no suggestion or motivation in the cited prior

art to modify Richardson with Boogers to obtain the method of the Applicant's invention. Richardson teaches:

The invention also offers a marked improvement over conventional one step processes in that fewer or simpler purification/recycling steps are required to produce highly pure adipic acid in a cost efficient manner. (col. 2, lines 42-45).

One of ordinary skill in the art, on reading Richardson and Boogers would not be motivated to combine these references because Boogers only adds complexity to the simple process of Richardson, which easily isolates the desired dicarboxylic acid in solid form and removes the catalyst, starting materials and by-products from the desired dicarboxylic acids. In addition, the incorporation of Booger into Richardson would require the desired solid product formed in Richardson be used in the extraction step where it is exposed to impurities from which it had been separated in Richardson. The use of the dicarboxylic acids as claimed in Boogers requires using at least some of the solid product of Richardson, thus reducing reaction yields of the desired product. Therefore there is no motivation or suggestion in the cited prior art to modify the invention of Richardson with the cited prior art to obtain Applicant's invention.

To establish a *prima facie* case of obviousness, there must be a reasonable expectation of success. There is no reasonable expectation of success in obtaining the method of the Applicant's invention by making changes to the process of Richardson based on the teachings in Boogers. Boogers is related to the carbonylation reactions, while Richardson is related to oxidation reactions. There is not a reasonable expectation of success in obtaining the Applicant's invention by combining Richardson, Pesa and Wu with Boogers because the process streams in

oxidation reactions are chemically distinct from those in carbonylation reaction and separation/purification processes depend upon the impurities present, which are different between the two types of reactions. Absent teachings from prior art concerning the same type of reaction as taught in Richardson, there could not have been a reasonable expectation of success in obtaining the Applicant's invention from the cited prior art. Therefore, there was no reasonable expectation of success at the time of the invention that the claimed method could be obtained by modifying Richardson.

To establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The Office Action combined elements of nonanalogous prior art related to different types of reactions in making this rejection. As shown above, one of ordinary skill in the art would realize there are various significant differences between reaction types and that one cannot combine elements related to different reactions absent the previous use of the element in the same type of reaction. Therefore the cited prior art does not teach or suggest all of the limitations of the instant claims through the use of relevant (analogous) prior art.

Therefore Claims 22-24, 28 and 31 are not obvious for the reasons described above with the rejection of Claim 20.

Applicants therefore respectfully request the withdrawal of these rejections.

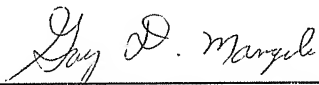
In view of the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order. Such action is earnestly solicited.

In the event that there are any questions related to this response, or the application in general, it would be appreciated if the Examiner would telephone the undersigned attorney at the below-listed telephone number concerning such questions so that prosecution of this application may be expedited.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: February 9, 2009

By: 
Gary D. Mangels, Ph.D.
Registration No. 55424

P.O. Box 1404
Alexandria, VA 22313-1404
703 836 6620